

December 1970

Brief 70-10686



AEC-NASA TECH BRIEF



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Single-Level Resonance Parameters Fit Nuclear Cross-Sections

For the first time, least-squares analyses of experimental differential cross-section data for the nucleus U^{235} have yielded single-level Breit-Wigner resonance parameters that fit, simultaneously, three nuclear cross-sections — capture, fission, and total. Previous measured values of the parameters yielded derived cross-sections that agreed at best with only one or two of the three measured cross-sections.

The resonance-capture and fission integrals calculated from the resonance parameters obtained for neutron energies of less than 63 eV agree within 3% with the corresponding direct numerical integration of the cross-section data. Earlier simultaneous measurements of the fission and capture cross-sections for U^{235} (ref. 1) were used in the analyses, resolving the discrepancy between measured and calculated values of the quantity \bar{a} (\bar{a} = ratio of capture-resonance integral to fission-resonance integral).

Two sets of resonance parameters have been derived. They differ only in that unit weighting was used in one analyses, while weighting inversely proportional to the cross-section was used in the other. In addition, the effects of fitting only two of the three nuclear cross-sections — total and fission, and capture and fission — were studied.

Two multigroup cross-section libraries for the reaction (neutron + U^{235}) have been generated. Each library treats a different section of the energy range to which the two sets of resonance parameters were applied. The value, 0.51, calculated for the ratio \bar{a} for either library agrees with the accepted

value, 0.50 ± 0.02 , derived from reactor integral measurements.

The two sets of resonance parameters and the cross-section libraries should be useful in reactor calculations for any nuclear reactor fueled with U^{235} .

Reference:

de Saussure, G.; et al.: Measurement of the Neutron-Capture and Fission Cross Sections and of Their Ratios \bar{a} for U^{233} , U^{235} , and Pu^{239} . Preprint CN23/48, Intern. At. Energy Agency Conference on Nuclear Data: Microscopic Cross Sections and Other Data Basic for Reactors, Paris, 1966.

Note:

Requests for further information may be directed to:

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AEC-NASA Space Nuclear Propulsion Office
U.S. Atomic Energy Commission
Washington, D.C. 20545
Reference: B70-10686

Patent status:

No patent action is contemplated by the AEC or NASA.

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under contract to
Space Nuclear Propulsion Office
(NUC-10101)

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